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CASE REPORT

Severe hydroblast intra-abdominal injuries due to high-pressure water jet without penetration of abdominal cavity

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Introduction

High-pressure water jet injuries are an uncommon cause of trauma. A review of the literature over the last 30 years reveals a few case reports describing mainly damage to the soft tissues, vascular structures, and eyes. Few of these reports describe intra-abdominal injuries due to penetrating trauma. We describe an unusual case of high-pressure water jet injury, resulting in tears of the liver, diaphragm and perforation of large colon without penetration of abdominal cavity, a new pattern of injury, not previously described. The unique problems of making a correct diagnosis and planning the appropriate management are discussed.

Case report

A 25-year-old man was admitted to the trauma resuscitation area of Hillel-Yaffe Medical Center, which is a Level II trauma centre. He sustained injuries to his right chest, abdomen and left hand. According to the patient, he was hit by high-pressure water streams after having lost grip of the water injection device. He was not wearing any protective clothing.

On initial evaluation, he was haemodynamically stable and fully conscious. There were multiple whiplash-like abrasions on the trunk, mainly on the right flank. The skin next to the abrasions was extremely oedematous. The abdomen was diffusely tender with no other signs of peritoneal irritation. There were a few lacerations on his left forearm. The remainder of the examination was unremarkable.

After initial resuscitation, the patient was taken to the radiology department for further evaluation. The main findings on abdominal CT were multiple air bubbles and oedema of the anterior abdominal wall with no evidence of free fluid or any other intra abdominal pathology. CT of the chest revealed lung contusion in the right lower lobe.

Due to increasing restlessness and abdominal pain, we decided to perform an explorative laparotomy. At surgery, there was no free air inside the abdomen. Blood (300 ml) were detected in the Morrison's space. The peritoneum was intact. A 4-cm tear of the right dome of the diaphragm and few small lacerations of the right hepatic lobe were found and repaired with sutures. A small haematoma was found in the region of the hepatic flexure. A thorough examination revealed a small tear of the

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retroperitoneal ascending colon. Debridment and primary repair of the colon were performed. The post-operative course was unremarkable, and the patient was discharged a few days later.

Discussion

Injuries due to high-pressure injection were first described in the 1930s.[4] Since then, increasing use of industrial water jet devices has led to an increased number of reported cases of injuries due to this unique mechanism. Most of the reports published to date discuss injuries to the soft tissues, extremities and eyes.[2,3,4,6] Hydroblast injuries to the trunk have been reported in only six cases,[1] and a tear of the diaphragm due to such mechanism has not been reported before.

All the cases were due to penetrating injury, which was dependent on the velocity, type of device, and distance of the body part from the source of water injection. It is emphasized by many of these reports that penetration was classically through small entry wounds.[2,5,7]

In our case, we did not find any evidence of penetration. Nevertheless, the patient suffered significant intra-abdominal injuries, which suggests that the mechanism of injury may be different. We believe that the high-pressure water jet injury inflicted a blast like injury on the trunk, which led to severe abdominal injuries.

Water jet devices are mainly used in the industry. These devices push a given volume of water into high-pressure feeding lines. As technology advances, more and more sophisticated devices are manufactured that produce higher velocities and consequently higher pressures. Thus, a large component of injury may be due to kinetic energy given off by the water jet device. Different reports describe different devices capable of generating up 900 atmospheres, resulting in high water velocity of 300 m/s.[1,8] Damage from exposures to kinetic energies as high as these, should result in devastating if not fatal injuries.

CT scan did not reveal the severity of injuries inflicted upon our patient. Once the patient developed peritoneal irritation signs he was operated on. This case suggests that one should have a high index of suspicion in a victim suffering from high-pressure jet injury, even if no penetration exists and subsequent imaging modalities do not reveal any significant injury. These patients should be hospitalised and rechecked for evolving signs of injuries. Physical findings such a subcutaneous oedema, which was found in our patient, may suggest a severe pattern of injuries.

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